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6.5 WATER RESOURCES

This section describes existing water resources in the Site region and vicinity, and potential impacts of the Project on those resources. The Site is located in an agricultural field, in the midst of an area of relatively featureless terrain and extensive farming. There are no natural drainages in the vicinity.

The Project will employ a diversified water strategy with a firm surface water supply as the primary source of water and a backup groundwater supply from nearby agricultural wells. The Project has secured a firm surface water supply from the KCWA. This surface water supply will meet the Project's average annual and peak daily water demand and will be delivered via the San Luis Canal and the City of Avenal turnout adjacent to the Site. The Project will bring a new supply of municipal and industrial water to Kings County, for its operations, without impacting the water supply in the surrounding area. The backup groundwater supply will be used under limited circumstances, such as times of an annual increase in power demand, interrupted canal flow, or events of elevated canal turbidity. Project groundwater use will be offset by an equivalent amount of groundwater conservation.

The Project design includes a ZLDF that will reduce water consumption and eliminate the need for process water disposal. The ZLDF is a water treatment system that will recover process purge streams, primarily cooling tower blowdown, for treatment and recycling of the process water back to the system. With the ZLDF, Project water consumption will be reduced by approximately 10 percent. In addition, it will allow the Project to operate without evaporation ponds or other conventional wastewater disposal technology and with no liquid discharge from the process.

Beneficial aspects of the Project related to water resources include:

- An increase in the Kings County water supply that can satisfy the water requirements of the Project. This water supports a significant new industrial operation in an area of limited industrial activity and tax base.
- The Project is designed to keep the consumptive use of fresh water to that which is minimally essential. The ZLDF will purify and recycle water and minimize Project water consumption by reducing water use approximately 10 percent.
- The power plant is designed to operate with zero liquid discharge. No NPDES permit or Waste Discharge Requirements are anticipated other than the State General NPDES permits for storm water discharge (associated with both construction and industrial activities).

- The Project will occur entirely within areas that have been intensively disturbed. There will be no impact to natural surface drainages or natural watershed areas.
- Backup groundwater supply use will be offset by irrigation conservation measures, so there will be no net increase in groundwater pumping from the existing wells.

Notices of Intent (NOIs) will be filed to comply with the State General NPDES permit for storm water discharges from construction activities (Water Quality Order 99-08-DWQ), and the State General NPDES permit for storm water discharges from industrial activities (Water Quality Order 97-03-DWQ). The NOIs for these permits are included in Appendix 6.5-1. No other RWQCB permitting information is required for the Project.

6.5.1 EXISTING CONDITIONS

Existing water resources in the region are described in the following sections:

- Section 6.5.1.1 - Surface Water Supply
- Section 6.5.1.2 - Runoff and Drainage Water
- Section 6.5.1.3 - Groundwater

6.5.1.1 Surface Water Supply

The San Luis Canal is located approximately 200 feet northeast of the Site. This canal is part of the California Aqueduct system and is used to import water to the southwestern San Joaquin Valley under the federal Central Valley Project (CVP) and the State Water Project (SWP).

The CVP includes water diversion, storage and distribution systems that stretch from the Cascade Mountains in northern California to the Tehachapi Mountains south of Bakersfield and is the dominant source of imported water to dry areas of the San Joaquin Valley. The CVP project was designed and built to protect affected areas of the state from water shortages and floods (USBR, 2001). The CVP annually delivers about 7 million acre-feet of water for agriculture, urban and wildlife use. The majority of this water, about 5 million acre-feet, is for agriculture, enough to irrigate about 3 million acres, or approximately one-third of the agricultural land in California.

The SWP was designed and built to deliver water, control floods, generate power, provide recreational opportunities and enhance habitats for fish and wildlife (DWR, 1997). It consists of an array of dams, reservoirs, power plants, pumping plants, canals and aqueducts that store and transport water diverted from rainfall and snowmelt runoff in northern and central California.

The SWP provides water to central and southern California populations and approximately 600,000 acres of farmland. The SWP facilities were designed to meet a projected 1990 need of 4.0 million acre-feet per year. Actual demand, however, has not developed as projected.

The Project surface water supply derives from the KCWA Kern River Restoration Project and Water Supply Program that allowed KCWA to aquire an additional 40,000 acre-feet of water for, in part, the marketing of 10,000 acre-feet of water within or outside of the KCWA service area by the Nickel Family, LLC. The restoration project resulted in a net gain to KCWA of an annual average of approximately 30,000 acre-feet of Lower Kern River water. The 10,000 annual acre-feet of firm water supply KCWA agreed to provide, in order to obtain the rights to the annual average 40,000 acre-feet, is being marketed for municipal and industrial use, including power plant use.(1) The Project has secured a right to 2,250 annual acre-feet of the 10,000 acre-feet that has been placed on the water market. Water for the Project will be delivered upstream of the existing Avenal turnout.

The City of Avenal operates a water turnout on the San Luis Canal that provides raw water for the City treatment plant located near the northeast corner of the Site. The treatment plant produces potable-quality water which is piped over the Kettleman Hills to the developed area of the City and to the Avenal State Prison. Water quality data for the canal water obtained by the City is provided in Table 6.5-1.

6.5.1.2 Runoff and Drainage Water

The Site is located in the dry climate of the southwest San Joaquin Valley, in an area that has no natural surface water except immediately following larger than average rainstorms. The mean annual rainfall in the Site region is between 6 and 7 inches (Williamson, Prudic and Swain, 1989), and the average annual pan evaporation is approximately 65 inches (Kohler, Nordenson and Baker, 1959). Most of the surface waters that occur in the San Joaquin Valley result from drainage of large watersheds in the Sierra Nevada Range that bound the east side of the valley. The Coast

(1) DWR, Initial Study and Proposed Negative Declaration, Water Purchase Agreement between Kern County Water Agency and the California Department of Water Resources for the Environmental Account (February 8, 2001) and Kern County Water Agency Notice of Determination and De Minimis Impact Finding for the Kern River Restoration and Water Supply Program Negative Declaration (September 7, 2000).

TABLE 6.5-1

SAN LUIS CANAL WATER QUALITY

PARAMETER		LOCATION		
		AVENAL[1] (September 1999)	KETTLEMAN CITY[2] (March 2000)	KETTLEMAN CITY[2] (December 1999)
Cations				
Calcium (ppm)	Ca^{++}	15-20	18	18
Magnesium (ppm)	Mg^{++}	10-13	9	13
Sodium (ppm)	Na^{+}	36-50	28	69
Potassium (ppm)	K^{+}	2-3		
Barium (ppm)	Ba^{++}	0.0318-0.0381		
Anions				
Bicarbonate (ppm)	HCO_3^{-}	90	54	74
Carbonate (ppm)	CO_3^{--}	ND		
Hydrate (ppm)	OH^{-}	ND		
Chloride (ppm)	Cl^{-}	48-73	33	102
Sulfate (ppm)	SO_4^{--}	19-24	39	34
Nitrite (ppm)	NO_3^{-}	1.7-2.0		
Fluoride (ppm)	F^{-}	ND	< 0.1	< 0.1
Heavy Metals				
Aluminum (ppm)	Al^{+++}	0.05-0.34		
Arsenic (ppm)	As^{+++}		0.002	0.002
Boron (ppm)	B^{+++}		0.2	0.2
Cadmium (ppm)	Cd^{++}	ND		
Copper (Cupric) (ppm)	Cu^{++}	ND	0.003	0.003
Chromium (ppm)	Cr^{+++}		0.005	0.007
Iron Total (ppm)	Fe^{++}	0.11-0.28	0.026	0.084
Lead (ppm)	Pb^{++}	0.005-0.0191	< 0.001	< 0.001
Manganese (Manganous) (ppm)	Mn^{++}		0.006	< 0.005
Selenium (ppm)	Se^{++++++}		< 0.001	0.001
Zinc (ppm)	Zn^{++}		< 0.005	< 0.005
Water Characterization				
Specific Conductance (µ mhos/cm)	--	356-430	316	573
Total Dissolved Solids (TDS) (ppm)	--		179	304
Calcium Hardness as $CaCO_3$ (ppm)	--		35	45
Magnesium Hardness as $CaCO_3$ (ppm)	--		47	53
Total Hardness as $CaCO_3$ (ppm)	--		82	98
pH (SU)	--	7.8-8.1		
Turbidity (NTU0	--	1.4-4.0	22	5

31161/AFC Text/Tables (9/27/01/rm)

(1) Source: City of Avenal Water Treatment Plant, 1999.
(2) Data from http://wwwoco.water.ca.gov/monthly/monthly.menu.html.

Ranges that bound the west side of the valley have considerably lower elevations and smaller watershed areas than the Sierra Nevada Range. No perennial streams of any substantial size enter the valley from the west (Bertoldi, Johnston and Evenson, 1991). Sustained surface flows from the Coast Ranges occur only after extended wet periods (RWQCB, 1995).

The Project will not affect any perennial surface water body. With the exception of several small artificial water storage ponds, which would not be affected by the Project, the surface water that occurs in the vicinity is limited to agricultural runoff and to rainwater runoff that follows infrequent substantial rainstorms. The closest perennial stream is Arroyo Largo, which terminates more than 1 mile east of the Site (see Figure 6.5-1).

Soil at and adjacent to the Site consists of Wasco Sandy Loam that is characteristically well-drained with moderately rapid permeability. Lands on and adjacent to the Site are in active agriculture, and periodic tilling, combined with the sandy soil, results in infrequent runoff. Figure 6.5-2 shows current drainage in the Site vicinity. On the infrequent occasions when surface drainage occurs, it flows generally northeast and either infiltrates or evaporates where it ponds in shallow topographic depressions along the west side of the San Luis Canal.

The Site and Project linear facilities are located outside of the 100-year flood zone (FEMA, 2000). The Site vicinity is not subject to tsunami run-up because it is separated from the coast by a distance of approximately 65 miles and the intervening topography of the Coast Ranges.

6.5.1.3 Groundwater

While groundwater will be a backup water supply and there will be no impact on groundwater pumping, the following sections provide an overview of the regional and local groundwater conditions to conform with the Commission's AFC information requirements. A more detailed description of regional and local aquifer properties is provided in Appendix 6.5-2.

6.5.1.3.1 San Joaquin Valley

Geologically, the San Joaquin Valley is the largest groundwater basin in California. The watershed area of the valley encompasses more than 35,000 square miles, and groundwater is stored in the sedimentary basin of the valley floor, which encompasses approximately 13,500 square miles (see Figure 6.5-3). Within this area, groundwater is stored in the interstitial spaces between grains of the sedimentary deposits that have accumulated in the bottom of the valley over geologic time. The maximum thickness of fresh water-bearing deposits is estimated at approximately 4,400 feet. The storage capacity between the surface and a depth of 1,000 feet is estimated at more than 570 million acre-feet, and the usable storage capacity exceeds 80 million acre-feet. Aquifers in the basin are prolific water producers, with well yields up to 3,200 gallons per minute (gpm) and averaging 1,100 gpm (DWR, 1994).

Section 6.3 - Geologic Hazards and Resources, provides a description of geologic conditions and the sequence of marine and continental deposits that occur beneath the ground surface in the Site region. The geologic materials that comprise the aquifer systems in the region are predominantly the Tulare Formation and overlying sediments (see Figure 6.5-4). These continental deposits have accumulated as alluvial fan, deltaic, flood plain, lake and marsh sediments and consist predominantly of lenses of gravel, sand, silt and clay (Page, 1983). Fine-grained materials (i.e., silt, sandy silt, sandy clay and clay) constitute more than 50 percent of the aquifer systems in some areas, but most of the fine-grained lenses are not extensive horizontally. A notable exception is the Corcoran Clay Member of the Tulare Formation, which underlies most of the western side of the San Joaquin Valley.

The entire thickness of continental deposits has been characterized as one system that has varying vertical leakance and confinement, depending on the properties of the fine-grained lenses that occur throughout the system. The degree of confinement generally increases with depth, and below the upper few hundred feet the aquifer is considered to be virtually confined everywhere (Bertoldi, Johnston and Evenson, 1991; Williamson, Prudic and Swain, 1989).

6.5.1.3.2 Site and Vicinity

For purposes of managing groundwater and data collection, the DWR has divided the San Joaquin Valley into 15 separate basins (DWR, 1980). The Site is located in the Westside Basin, as shown in Figure 6.5-5. The Westside Basin consists mainly of lands within the Westlands Water District.

Well yields in the Westside Basin range from 400 to more than 2,000 gpm and typically range between 800 and 1,500 gpm. Water is produced from wells as deep as 3,000 feet, with typical depths ranging between 600 and 1,200 feet. Pump lifts are typically between 200 and 800 feet.

Based on Westlands Water District maps (Westlands Water District, 2001), the western edge of the Corcoran clay approximately coincides with the location of the San Luis Canal in the Site vicinity (Figure 6.5-6). Beneath the Site, there is regional aquifer with a piezometric surface approximately

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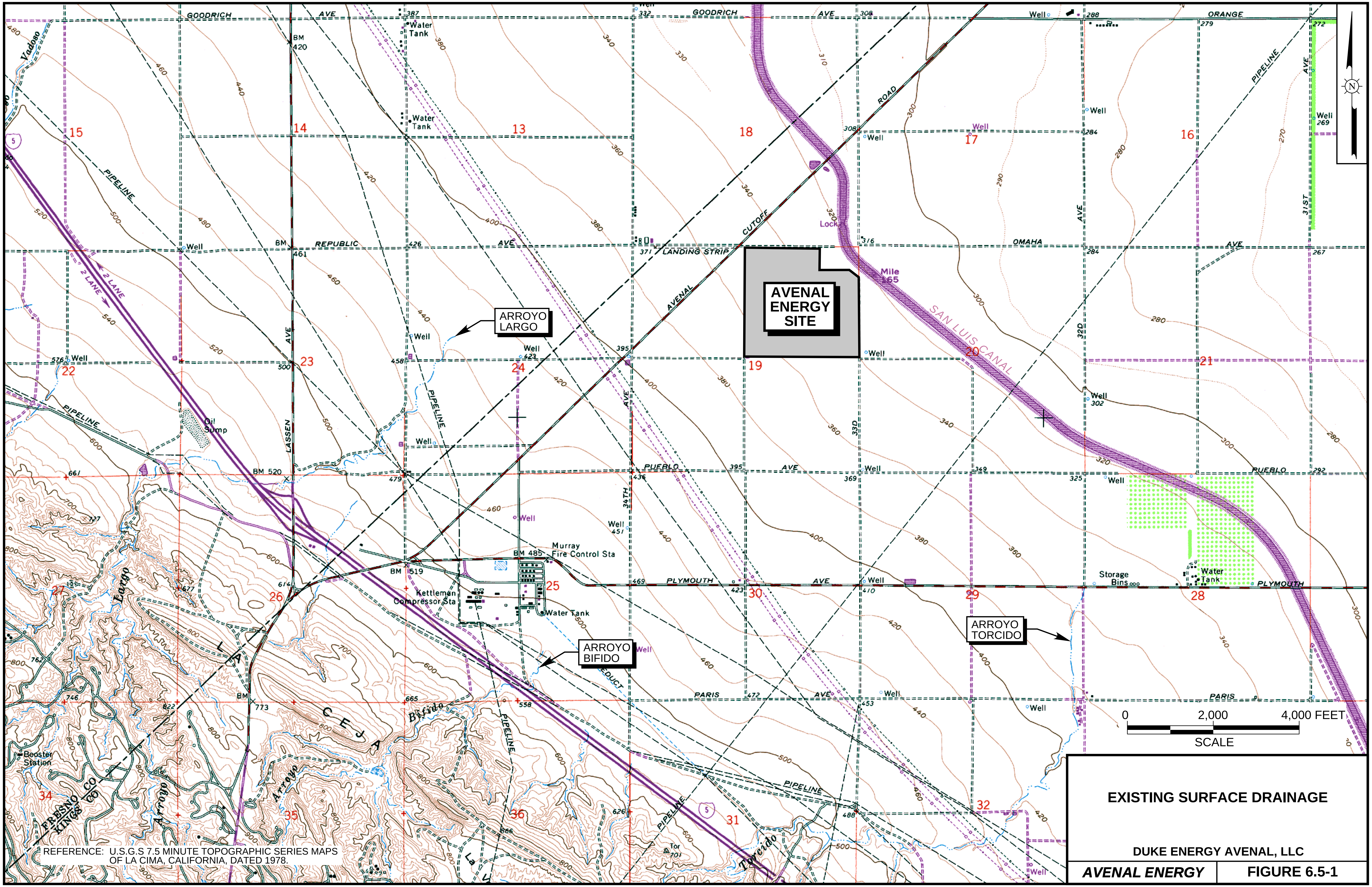
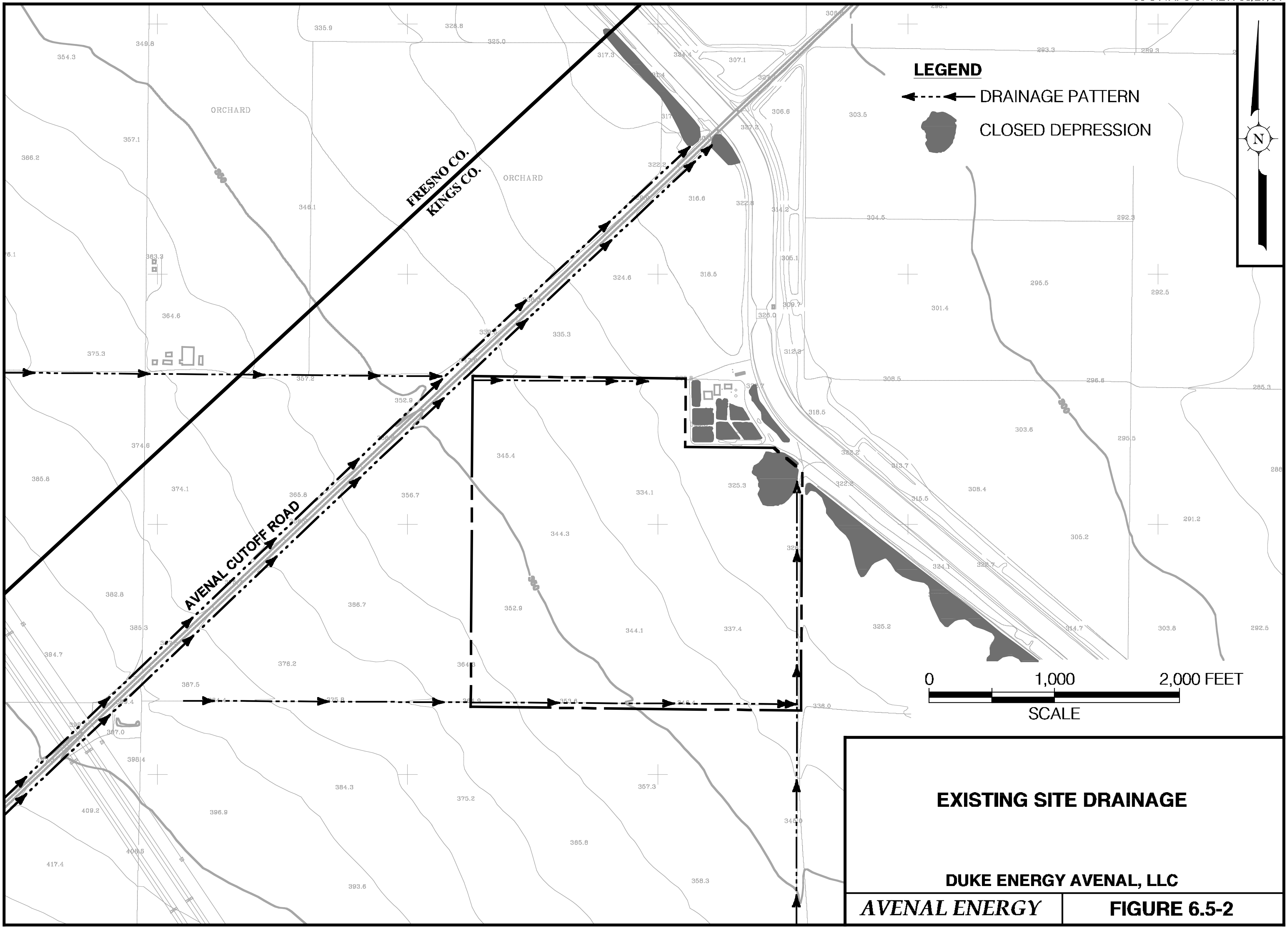


EXISTING SURFACE DRAINAGE

DUKE ENERGY AVENAL, LLC

AVENAL ENERGY	**FIGURE 6.5-1**



EXISTING SITE DRAINAGE

DUKE ENERGY AVENAL, LLC

AVENAL ENERGY	**FIGURE 6.5-2**

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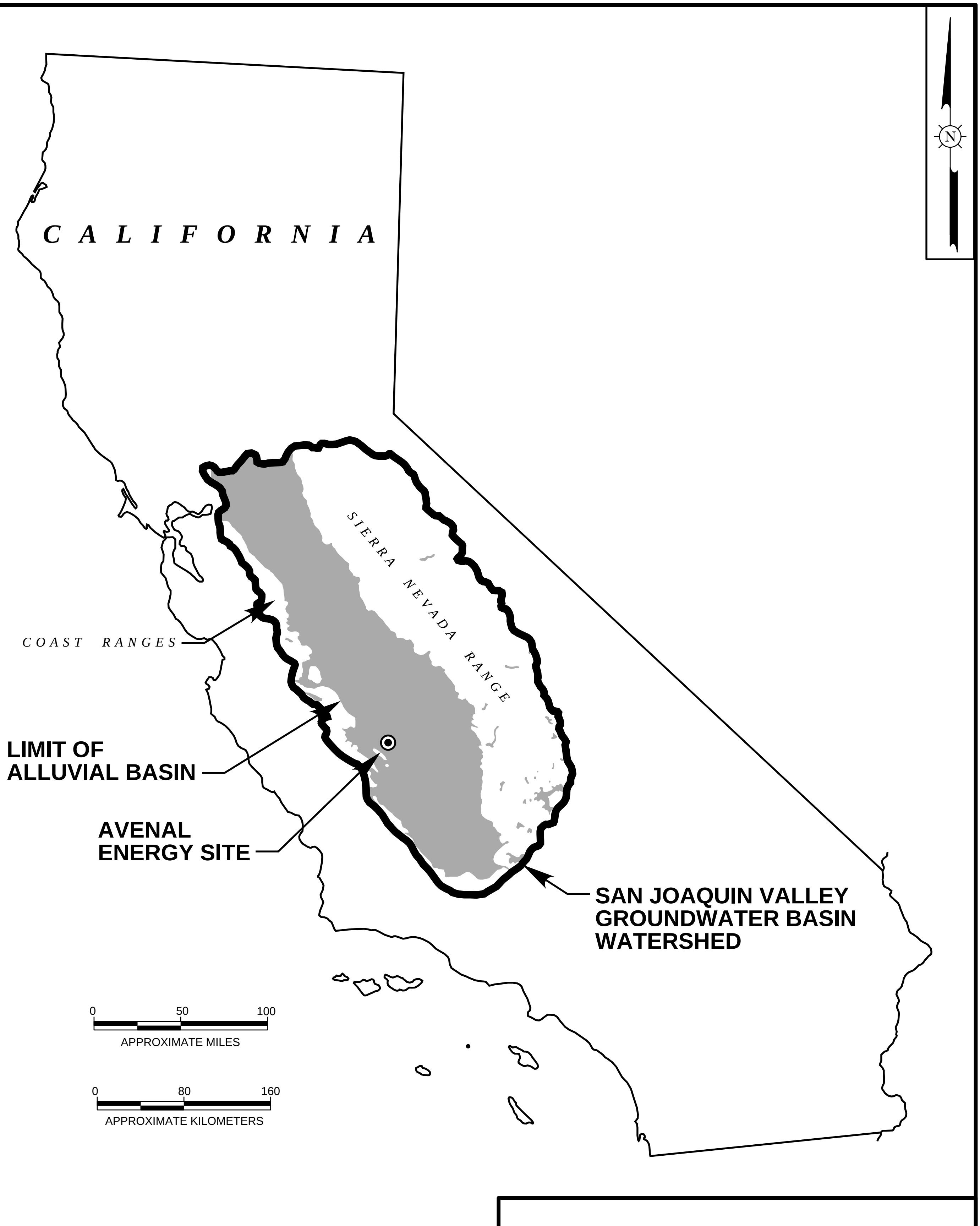

SAN JOAQUIN VALLEY WATERSHED
AND ALLUVIAL BASIN

DUKE ENERGY AVENAL, LLC

AVENAL ENERGY	FIGURE 6.5-3

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LEGEND

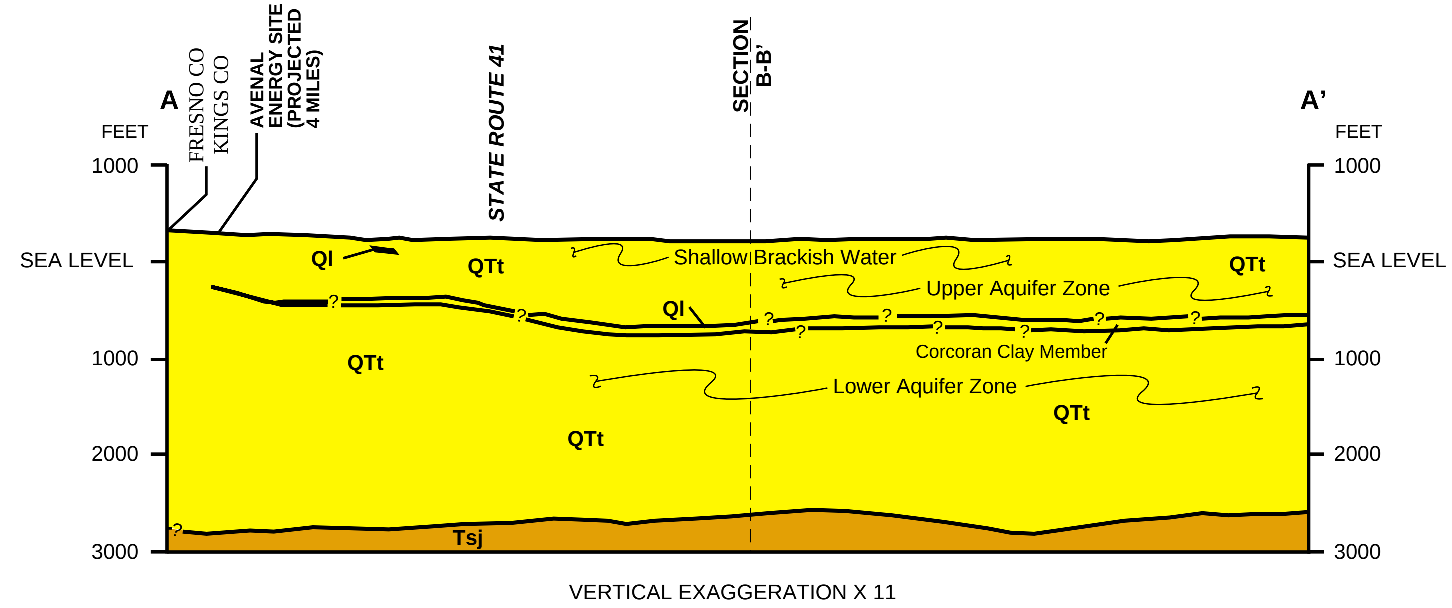
QTt — TULARE FORMATION AND OTHER CONTINENTAL DEPOSITS (HOLOCENE TO PLIOCENE)

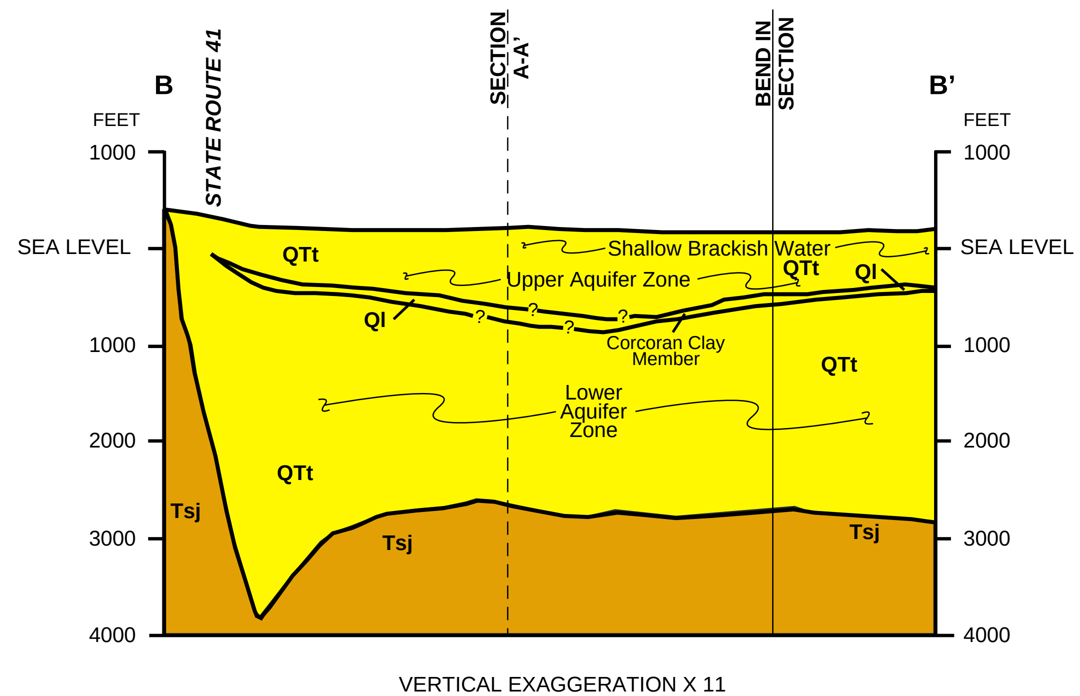
Ql — LACUSTRINE AND MARSH DEPOSITS (PLEISTOCENE AND HOLOCENE)

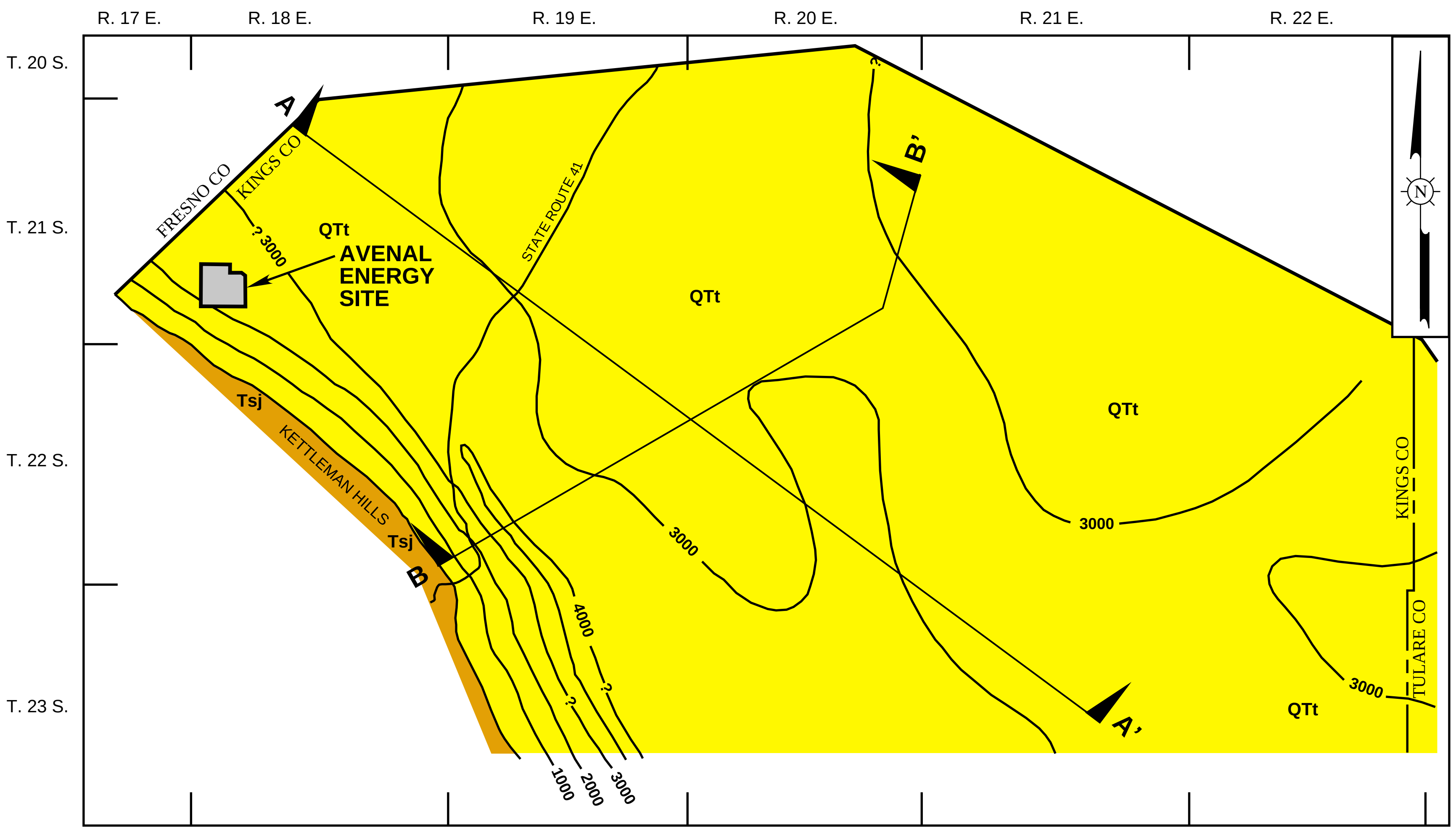
Tsj — SAN JOAQUIN FORMATION (PLIOCENE)

A A' — LINE OF GEOLOGIC SECTION

3000 — LINE OF EQUAL DEPTH AND THICKNESS OF TULARE FORMATION AND OTHER CONTINENTAL DEPOSITS
Approximately located; queried where data are inconclusive.
Datum is land surface.





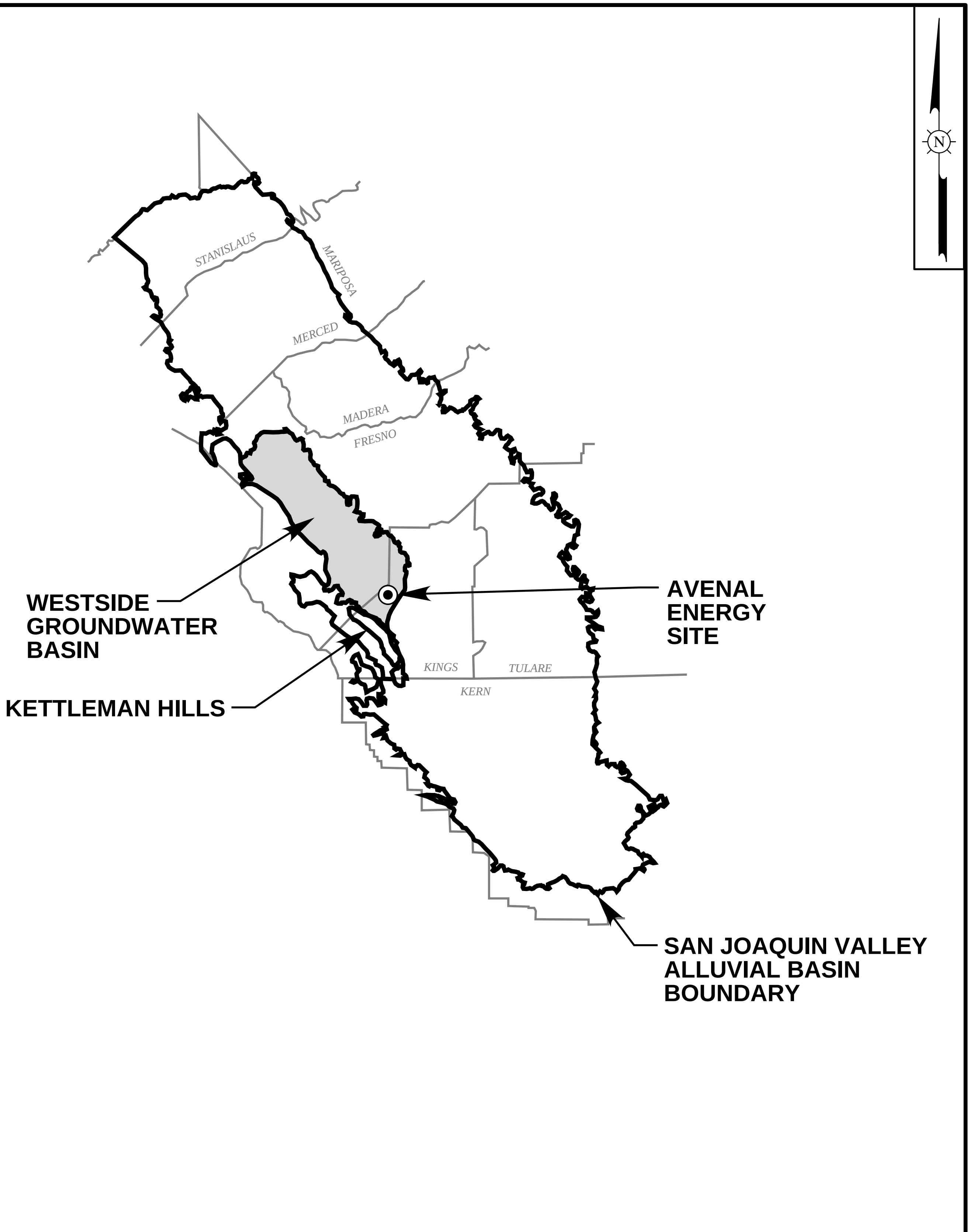


REFERENCE: ADAPTED FROM PAGE, R.W., 1983.

REGIONAL AQUIFERS CROSS-SECTIONS

DUKE ENERGY AVENAL, LLC

AVENAL ENERGY | FIGURE 6.5-4



REFERENCE:
DWR, 2001.
<http://wwwdpla.water.ca.gov/sjd/groundwater/basinmap.html> (1/23/01)

WESTSIDE GROUNDWATER BASIN

DUKE ENERGY AVENAL, LLC

AVENAL ENERGY

FIGURE 6.5-5

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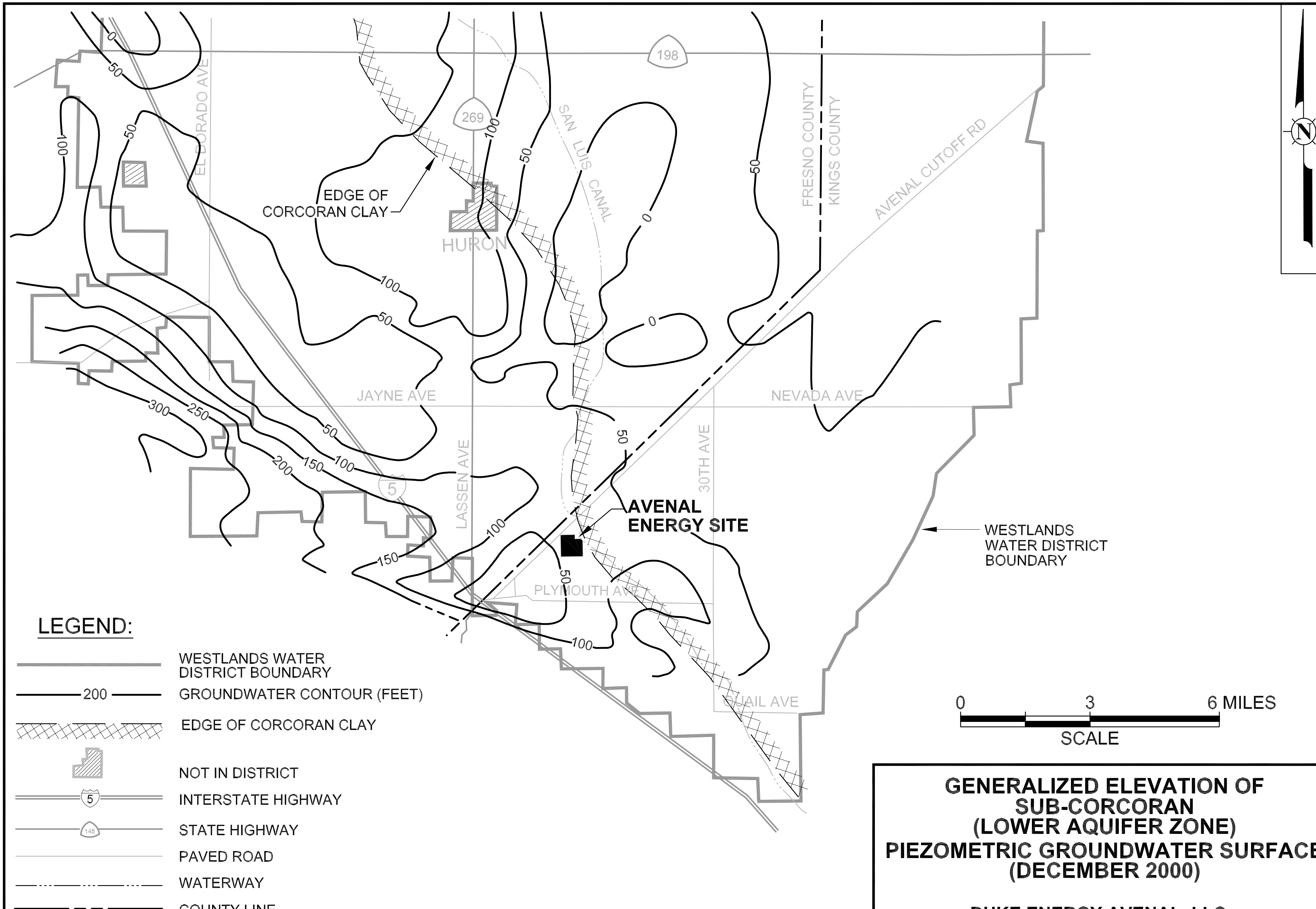

Reference: Westlands Water District, July 2001.
<http://www.westlandswater.org/Maps/SGWMapSel.htm>

GENERALIZED ELEVATION OF SUB-CORCORAN (LOWER AQUIFER ZONE) PIEZOMETRIC GROUNDWATER SURFACE (DECEMBER 2000)

DUKE ENERGY AVENAL, LLC

AVENAL ENERGY | **FIGURE 6.5-6**

250 to 300 feet below the ground surface. This aquifer zone extends eastward below the Corcoran Clay east of the Site; it is referred to as the Sub-Corcoran (Lower) Aquifer zone. This lower aquifer is a confined aquifer and piezometric surface contours for this aquifer zone are shown in Figures 6.5-6 and 6.5-7. Moving eastward from the San Luis Canal alignment in the Site vicinity, an upper semiconfined regional aquifer begins to occur above the Corcoran Clay. East of the San Luis Canal in the Site vicinity, the piezometric surface in this upper aquifer is approximately 200 to 250 feet below the ground surface (see Appendix 6.5-2). A third groundwater system begins to occur a few miles to the east of the Site where the valley floor is at a lower elevation and irrigation water collects above shallow clay layers resulting in a near surface brackish water table. This shallow brackish water table does not occur near the Site and is further described in Section 6.5.1.3.3.

The total annual groundwater extraction from the Westside Basin is approximately 213,000 acre-feet. This extraction is almost exclusively agricultural. The yield of the basin is estimated at 200,000 acre-feet, so the basin is considered to be in an overdraft condition of 13,000 acre-feet per year (DWR, 2001). The Project will not impact groundwater conditions in the basin, because groundwater used by the Project will be entirely offset by a reduction in agricultural use, as described further in Section 6.5.2.

The backup water supply will use water supply wells located near the Site (see Figure 2.1-5). Characteristics of these wells are summarized in Table 6.5-2. The quality of groundwater from these wells is shown in Table 6.5-3. The existing wells are used for agricultural water for Kochergen Farms, the owner and operator of agricultural operations on the Site and contiguous lands. Under existing conditions, these wells are pumped as needed to irrigate orchards and row crops that occur on the Site and surrounding lands.

TABLE 6.5-2

SUMMARY OF EXISTING SITE WELLS

WELL PARAMETER	WELL IDENTIFICATION		
	18-1	18-4	24-5
Depth	1,176 feet	1,140 feet	1,140 feet
Diameter	16 inches	16 inches	16 inches
Depth of Pump	510 feet	560 feet	600 feet
Production Capacity	1,275 gpm	2,320 gpm	1,100 gpm

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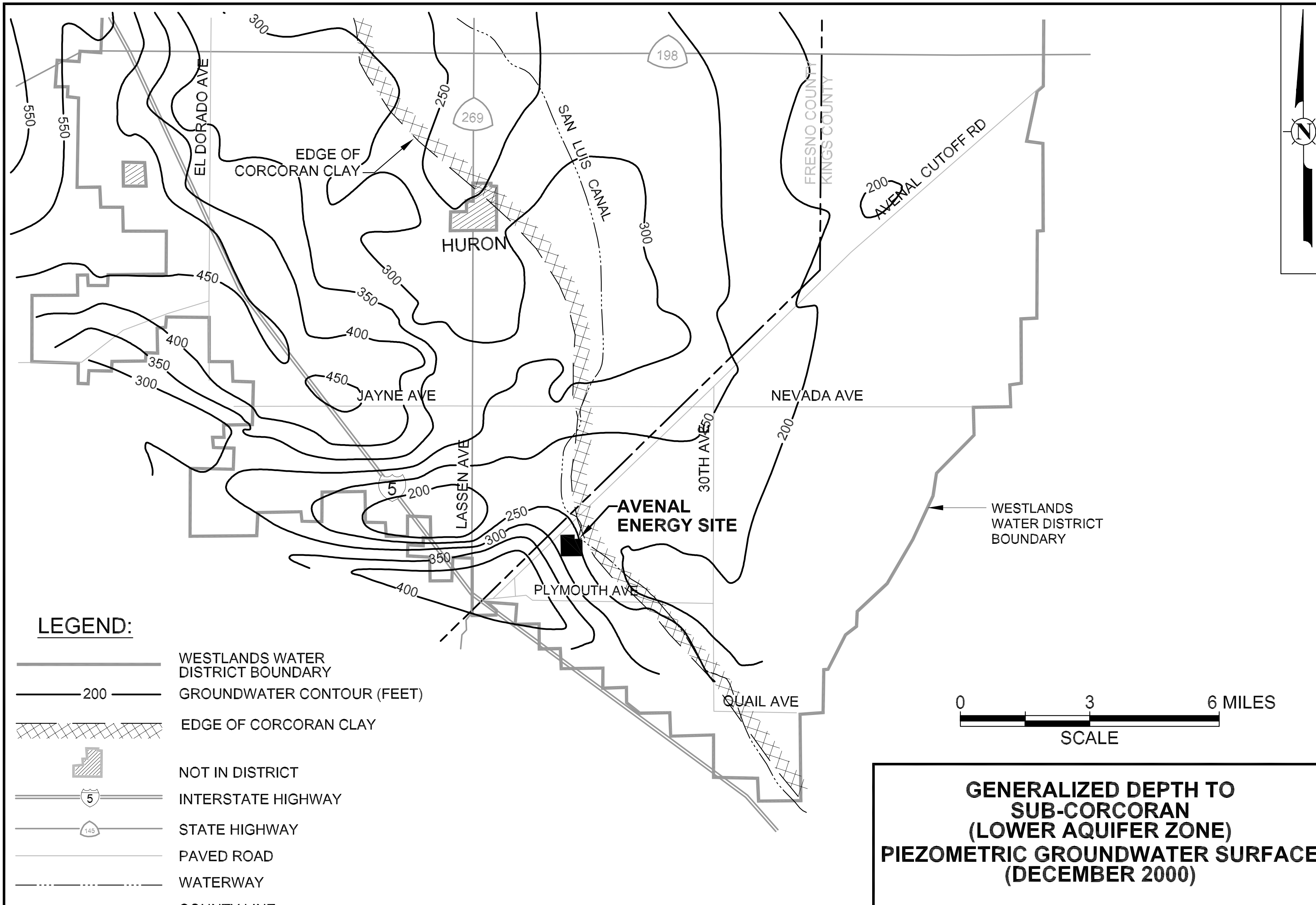

Reference: Westlands Water District, July 2001.
<http://www.westlandswater.org/Maps/SGWMapSel.htm>

GENERALIZED DEPTH TO SUB-CORCORAN (LOWER AQUIFER ZONE) PIEZOMETRIC GROUNDWATER SURFACE (DECEMBER 2000)

DUKE ENERGY AVENAL, LLC

AVENAL ENERGY

FIGURE 6.5-7

TABLE 6.5-3

GROUNDWATER QUALITY[1]

WELL		18-1	18-4	24-5
COMPONENTS		ppm_w as Ion	ppm_w as Ion	ppm_w as Ion
Cations				
Calcium	Ca^{++}	84.8-88	93.2-100	87.5-90
Magnesium	Mg^{++}	38.30	44.60	26.80
Sodium	Na^{+}	120.00	120.00	170.00
Potassium	K^{+}	3.70	0.90	1.90
Ammonia	NH_4^{+}	< 0.68	<0.68	<0.68
Barium	Ba^{++}	0.40	0.06	0.02
Anions				
Bicarbonate	HCO_3^{-}	106.56	101.93	73.89
Chloride	Cl^{-}	43.20	54.50	73.50
Sulfate	SO_4^{--}	410-763	460-700	420-620
Nitrate	NO_3^{-}	12.30	16.80	32.80
Fluoride	F^{-}	0.20	0.20	0.10
Phosphate (as ortho-PO_4)	PO_4^{---}	< 0.1	<0.01	<0.1
Total Phosphorous (Valance 3)	P^{---}	0.5	0.16	0.22
Borate	$B_4O_7^{--}$	1.40	6.30	6.30
Bromide	Br^{-}	0.10	0.3	0.50
Heavy Metals				
Aluminum	Al^{+++}	< 0.03	0.15	<0.03
Arsenic	As^{+++}	< 0.1	<0.01	<0.1
Boron	B^{+++}	0.40	0.50	0.50
Cadmium	Cd^{++}	0.006	<0.005	<0.005
Copper (Cupric)	Cu^{++}	ND	ND	ND
Chromium	Cr^{+++}	0.30	<0.015	<0.015
Iron (Ferrous)	Fe^{++}	ND	ND	ND
Iron (Ferric)	Fe^{+++}	ND	ND	ND
Iron Total	Fe^{++}	ND	ND	ND
Lead	Pb^{++}	ND	ND	ND
Lithium	Li^{+}	ND	ND	ND
Manganese (Manganous)	Mn^{++}	ND	ND	ND
Mercury	Hg^{++}	ND	ND	ND
Molybdenum	Mo^{++++++}	ND	ND	ND
Nickel	Ni^{++}	ND	ND	ND
Selenium	Se^{++++++}	ND	ND	ND
Silver	Ag^{+}	ND	ND	ND
Strontium	Sr^{++}	1.30	1.50	1.50
Thallium (Thallic)	Tl^{+++}	ND	ND	ND
Tin	Sn^{++}	ND	ND	ND
Titanium	Ti^{++}	ND	ND	ND
Vanadium	V++	ND	ND	ND
Zinc	Zn^{++}	< 0.1	<0.1	<0.1
Silica				
Dissolved Silica as SiO_2^{--}	ppm	13	13	13
Colloidal Silica as SiO_2^{--}	ppm	35	35	35
Water Characterization				
Specific Conductance	µ mhos/cm	1,150	1,245	1,265
Total Dissolved Solids (TDS)	ppm	920	992	954.0
Total Alkalinity as $CaCO_3$	ppm	87.4	83.6	60.6
Calcium Hardness as $CaCO_3$	ppm	210	210	240.0
Magnesium Hardness as $CaCO_3$	ppm	160	180	110.0
Carbon Dioxide CO_2	ppm	ND	ND	ND
pH	SU	8.0	7.9	7.9
Turbidity	NTU	2.0	1.15	1
Total Suspended Solids (TSS)	ppm	14	9	2.0
TOC	ppm	ND	ND	ND
Color	APHA	10	10.0	10.0

31161/Rpts/AFC/Tables (9/21/01/mc)

ND = None detected.

(1) Wells 18-1, 18-4 and 24-5 sampled April 2001.

Source: Duke/Fluor Daniel, 2001.

6.5.1.3.3 Brackish Groundwater

Irrigation water collects above shallow clay layers that occur in the central portion of the valley, resulting in near-surface brackish groundwater throughout much of the central and eastern parts of the Westlands Water District. The quality of this water is poor due to salt loading from agricultural water and from soluble salts dissolved in the Coast Ranges-derived alluvium as excess irrigation water percolates downward and toward the axis of the valley. Figure 6.5-8 provides April 2001 depth contours for the brackish water. As shown, brackish groundwater occurs within 5 feet of the surface, beginning about 4 miles east of the Site. The original authorization for the Westlands Water District included provisions for drainage facilities that would have removed the brackish water, but these facilities were never completed. The salt buildup is currently managed primarily through irrigation management. In addition, land retirement and export of salt are planned to mitigate salt buildup problems in some areas of the district (Westlands Water District, 1999).

6.5.1.4 <u>Water Resource Policies and Plans</u>

6.5.1.4.1 Basin Plan

The RWQCB Basin Plan for the Site region designates groundwater beneficial uses as Municipal and Domestic Supply, Agricultural Supply and Industrial Service Supply (Central Valley RWQCB, 1995). The intermittent streams in the Project region have designated beneficial uses of Agricultural Supply, Industrial Service Supply, Water Contact Recreation, Non-Contact Water Recreation, Warm Freshwater Habitat, Wildlife Habitat, Rare Threatened or Endangered Species Habitat and Groundwater Recharge. In accordance with Section 303 of the Clean Water Act, and the Porter-Cologne Water Quality Control Act, the Basin Plan includes water quality objectives and implementation policies to enhance beneficial uses and protect beneficial uses against water quality degradation. Water quality objectives are achieved primarily through the adoption of Waste Discharge Requirements (including federal NPDES permits) and through enforcement orders.

Irrigated agriculture accounts for most of the water used in the basin. The Basin Plan identifies salts transported into the basin in imported irrigation water and salts leached out of soil by irrigation water to be a crucial problem (Central Valley RWQCB, 1995). The Basin Plan recognizes that the subsurface drainage of applied agricultural water will be a constant threat to water quality unless salts are removed from the system.

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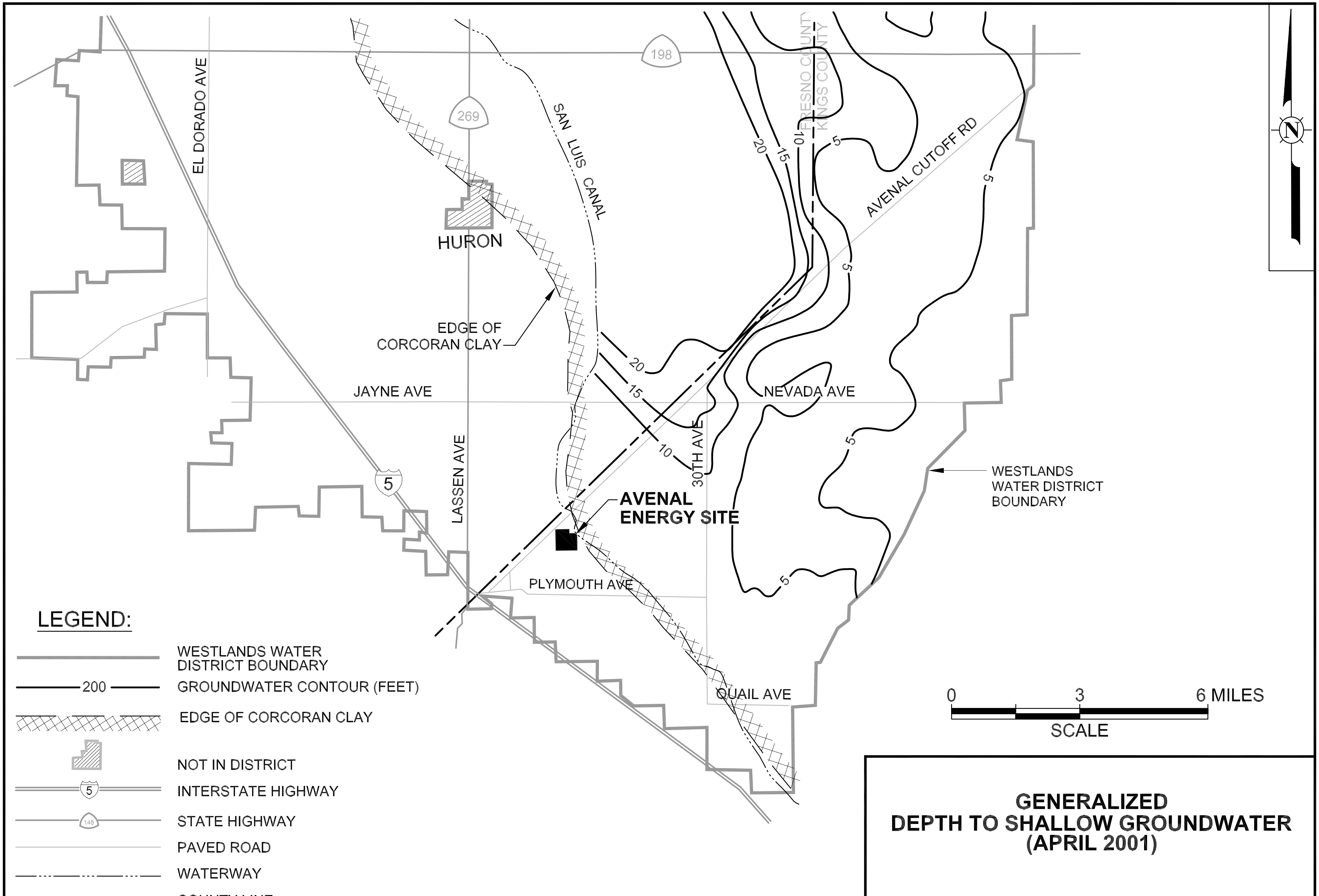

Reference: Westlands Water District, July 2001.
<http://www.westlandswater.org/Maps/SGWMapSel.htm>

GENERALIZED DEPTH TO SHALLOW GROUNDWATER (APRIL 2001)

DUKE ENERGY AVENAL, LLC

AVENAL ENERGY	**FIGURE 6.5-8**

The Project is consistent with the Basin Plan due to the following:

- The power plant is designed with a ZLDF, which purifies and recycles blowdown water. With the ZLDF, there is no process wastewater discharge from the power block.
- The Project will comply with the State General NPDES permits for storm water runoff during construction (WQO 99-08-DWQ) and operations (WQO 97-03-DWQ).
- As described in Section 6.5.2, groundwater pumped to provide backup supply to the Project will be completely offset by a reduction in agricultural water use on the Site and contiguous property, so there will be no net increase in groundwater pumping. Additional discussion of measures to offset the Project's groundwater pumping is provided in Section 6.5.2.2.

6.5.1.4.2 Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling (Resolution No. 75-58)

The design of the facility with a ZLDF to purify and recycle water at the Site, and the use of canal and groundwater for the Project are consistent with the water use preference hierarchy and water quality protection measures of the *Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling* (SWRCB, 1975). This policy includes the following relevant to the Project:

- A stated use of this policy is to guide planning of new power generating facilities to protect beneficial uses of the state's water resources and to keep the consumptive use of fresh water for power plant cooling to that minimally essential for the welfare of the citizens of the state. The Project is consistent with this guidance because it will not impact beneficial uses and because the use of fresh water is minimized through recirculation of cooling water and reclamation of cooling water blowdown.
- A basis of the policy is that disposal of once-through cooling water from power plants to inland water is incompatible with the SWRCB Thermal Plan and Water Quality Control Plans. The Project does not use once-through cooling. Cooling tower blowdown will be recycled through its zero discharge design.
- A basis of the policy is that improper disposal of cooling water blowdown may have an adverse impact on the quality of inland waters and on fish and wildlife. The Project is consistent with this through its zero discharge design. Salts will be removed from cooling water blowdown, and the purified water will be reused. Salts will be removed from the Site and disposed of at a permitted solid waste disposal facility.
- A basis of the policy is the necessary consideration of reductions in available quantity of water to meet Delta outflow requirements necessary to protect Delta water quality objectives and standards. The Project water supply will be from local water supply sources; there will be no new allocations or increase in water use from the Delta or local supplies.

- A position of the policy is that, where the SWRCB has jurisdiction, the use of fresh water as a source of power plant cooling water can be approved if site-specific environmental, technical or economic considerations make use of ocean water, brackish water or waste water either environmentally undesirable or economically unsound. The Project incorporates a ZLDF to minimize water use. Sources of water other than fresh water, including ocean water, brackish water and wastewater, were evaluated and found to be either environmentally undesirable or economically unsound, or both. These evaluations are described in Section 5.4.

6.5.2 IMPACTS

Significance criteria were determined based on CEQA Guidelines, Appendix G, Environmental Checklist Form (approved January 1, 1999) and on performance standards or thresholds adopted by responsible agencies. An impact may be considered significant if the project results in:

- Violation of RWQCB water quality standards or waste discharge requirements.
- Substantial alteration of the existing drainage pattern of the Site or area in a manner that would result in substantial flooding, erosion or siltation onsite or offsite.
- Substantial adverse change in physical conditions, creating runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional polluted runoff.
- Substantial depletion of groundwater supplies or substantial interference with groundwater recharge such that there would be a net deficit in aquifer volume or lowering of the local groundwater table.

6.5.2.1 Construction Impacts

6.5.2.1.1 Water Supply

Project construction will use water from existing groundwater wells. There will be corresponding conservation measures on agricultural groundwater pumping to ensure no net increase in groundwater pumping. Project construction will have no effect on surface water or groundwater supply resources. Delivery of any surface water or groundwater for construction purposes will utilize existing facilities.

6.5.2.1.2 Runoff and Drainage Water

As discussed in Section 6.5.1, the mean annual rainfall in the Site region is low (between 6 and 7 inches per year), and soils are sandy with moderately rapid permeability. Surface runoff during construction is expected to be infrequent. The surface runoff control systems are described in Section 2.3.17. There will be no discharges to water during construction except as authorized under the State General NPDES permit for storm water discharges from construction activities (WQO 99-08-DWQ). During construction, temporary berms, surface grading, silt fences, sandbags and other Best Management Practices (BMPs) will be implemented to control erosion and reduce or prevent pollutants from entering the storm water system. The BMPs will include an erosion control plan and other measures that will be implemented in accordance with the State General NPDES permit for construction activity on the Site and Project linear corridors. These measures will address soil moving, equipment laydown, material handling and other relevant activities that occur during the construction period. Conformance with the State General NPDES permit will assure that runoff during construction does not substantially alter erosion or siltation or violate water quality standards. Therefore, Project impacts related to storm water quality will be less than significant.

Site preparation will include grading of the power generation facility area, the switchyard area, construction laydown area, roads and a storm water detention basin. Storm water controls during construction will be designed to minimize changes to existing drainage patterns and to avoid flooding and minimize erosion and siltation. Figures 2.3-11 and 2.3-9 show the conceptual interim drainage plan for the Site during construction and the conceptual drainage plan for the end of construction, respectively. Comparison of the conceptual drainage plans to the existing Site drainage in Figure 6.5-2 shows that, on the infrequent occasions that runoff does occur, the change in runoff patterns will be minimal. Storm water runoff from the graded area will be collected by a surface drainage system and routed to a retention basin sized to retain runoff from the 25-year, 24-hour storm event. Similar to existing conditions, due to the topographic barrier of the canal dike, runoff from areas of the Site that do not flow to the retention basin will pond and evaporate or infiltrate in shallow closed depressions on and east of the Site. Due to the minimal magnitude of change in surface drainage through and around the Site, the impact of Project construction to storm water runoff patterns will be less than significant.

The Project linear facilities will be designed to not interrupt storm water drainage patterns. The gas pipeline interconnection will be underground along Avenal Cutoff Road and Plymouth Avenue. The electrical transmission line interconnection will primarily result in line tower footing disturbances and will not disrupt surface drainage. The water pipelines will be underground. Where construction activities occur in agricultural and road ditches (e.g., where the gas pipeline interconnection crosses drainages adjacent to the road), excavation, pipe installation and backfilling will occur during dry weather. Considering the minimal magnitude of change in surface drainage, the construction impact of Project linear facilities to storm water runoff patterns will be less than significant.

6.5.2.1.3 Groundwater

The Project will utilize an average of approximately 8,000 gallons per day of water during construction for dust control, soil compaction and other needs. For hydrotesting of the HRSGs and associated piping, a maximum daily water usage is estimated at 85,000 gallons. The hydrotesting of the HRSG and other piping is normally done toward the end of Project construction after the mechanical construction is complete. Construction water will be obtained from the three existing wells shown in Figure 2.1-5. This water use will be offset in the same manner as described for operations in Section 6.5.2.2, so there will be no increase in groundwater pumping compared to baseline existing conditions. Therefore, Project construction will not impact groundwater resources.

6.5.2.2 Operations Impacts

The Project operations water demands include makeup for the circulating (cooling) water system, boiler feed water makeup for the HRSGs, makeup for the closed-loop cooling water system and potable water makeup. The Water Balance Diagram in Appendix 2-8 provides the conceptual design of the water treatment processes and distribution. A detailed description of the peak and average water usage, and a description of facilities to be used in water conveyance and treatment are provided in Section 2.3.7. The following provides a brief recap of water uses at the facility:

- Makeup water to the circulating water system, the primary Project water demand, will be supplied directly from the raw water softener clarifier system and from excess distillate from the ZLDF.
- Boiler feed water makeup to the HRSGs, demineralization is provided through an EDI system and mixed-bed polishing unit.
- Service water makeup to the closed-loop cooling water system, which is used to cool equipment such as the CTG and STG lubrication oil coolers, the CTG and STG generator coolers, air compressor after coolers, steam cycle sample coolers, etc.
- Potable water will be provided to the Site by the City of Avenal from the existing water treatment plant.

Project water requirements are summarized in Table 6.5-4.

TABLE 6.5-4

DAILY AND ANNUAL AVERAGE PROJECT WATER DEMAND(1)

WATER SERVICE/USE	ANNUAL USE(1)	AVERAGE DAILY USE	MAXIMUM DAILY USE
Clarified Water to Plant Cooling Tower Makeup	2,149 AFY	1,332 gpm	2,869 gpm
Clarified Water to Auxiliary Cooling Towers Makeup	80 AFY	50 gpm	261 gpm
Clarified Water to Service Water System	14 AFY	9 gpm	13 gpm
City of Avenal Water to Potable Water System	3 AFY	2 gpm	3 gpm
Total Plant Water Usage Requirements	**2,246 AFY**	**1,393 gpm**	**3,146 gpm**

(1) See Table 2.3-1 for basis of water use estimates.

The surface water supply is adequate for the Project's normal operations (see Table 6.5-4). The backup groundwater supply will be used under limited circumstances, such as times of higher annual power demand, interrupted canal flow or events of elevated canal turbidity. The rationale for selecting both a firm surface water supply and a backup groundwater supply for the Project's water demand is to employ a reliable water supply that ensures efficient power plant operations. The rationale for using fresh water for Project needs is that it is the most efficient and environmentally preferable source of cooling water. There is no feasible source of ocean water, brackish water or wastewater available for the Project that would be environmentally preferable (see Section 5.4).

The Project incorporates a ZLDF that minimizes water consumption by purifying and recycling process blowdown instead of the conventional technology of blowdown disposal. With the ZLDF to recycle process blowdown, there will be no wastewater discharge from the plant. All of the process water will be recycled. The only effluent discharges from the Project will be the sanitary sewer and storm water. The sanitary sewer system will be connected to a septic tank with leach field. Storm water is discussed in the following Section 6.5.2.2.2.

Considering the high demand in the state for a reliable and cost-effective energy supply, and considering the importance of satisfying this demand for the state's population and economy, the proposed system limits the consumptive use of fresh water to that which is minimally essential for the welfare of the citizens of the state. Alternatives to the Project that were evaluated to determine if fresh water consumption could be further reduced are described in Section 5.4. The following subsections describe potential water resource impacts of Project operations to surface and groundwater.

6.5.2.2.1 Surface Water Supply

The KCWA will supply local water via the San Luis Canal to meet the average annual and maximum daily needs of the Project as set forth in Table 6.5-4. A letter describing the conditions and delivery of the KCWA water to the Site is included in Appendix 6.5-3. The 2,250 AFY of KCWA water derives from a portion of an existing surface water entitlement that has already received necessary environmental review. KCWA will exchange this local water supply for SWP water or other water for delivery to the Project via the San Luis Canal.

It will not be physically feasible to deliver the KCWA local water directly to the Project. Therefore, the KCWA local water will be provided to the Project by using the SWP and California Aqueduct (San Luis Canal). Each acre-foot of KCWA SWP entitlement or other water delivered to the Project will be replaced by an acre-foot of KCWA local water that will be delivered to KCWA member units in lieu of SWP entitlement. The KCWA's annual SWP entitlement is in excess of 1 million acre-feet.

The surface water supply secured by the Project will not result in any environmental impacts to the KCWA service area. Environmental analysis for use of the KCWA local water has been completed. The exchange between local water and SWP water will not alter diversions from the Delta to the California Aqueduct. In the absence of the exchange, the same quantity of SWP entitlement and other KCWA water will have been diverted from the Delta to the California Aqueduct and delivered to KCWA member units. Other SWP contractors and KCWA member units will not be affected by the exchange.

Because this local surface water supply is part of the larger Kern River Restoration Project, there is a benefit to the KCWA service area as KCWA was able to obtain a net increase of an annual average of 30,000 acre-feet of water for its local water projects.[2] The Project is also providing a benefit to Kings County by bringing a new supply of water to the County for industrial use by the Project. There will be no adverse impact to the local water supply.

6.5.2.2.2 Runoff and Drainage Water

The Project's surface runoff control systems are described in Section 2.3.17.

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(2) KCWA Notice of Determination and De Minimis Impact Finding for the Kern River Restoration and Water Supply Program Negative Declaration (September 7, 2000).

The Project will operate under the State General NPDES permit for storm water discharges from industrial activities (Water Quality Order 97-03-DWQ). Surface grading will be designed to control flows from the 10-year, 24-hour storm. Design criteria for the Site drainage system are provided in Appendix 2-1, Civil Engineering Design Criteria. Clean storm water runoff from the developed portion of the Site will be collected via a surface water drainage system and routed to a retention basin, where water will evaporate and percolate. BMPs will be implemented to minimize storm water contact with potential pollutants and to reduce or prevent pollutants from entering storm water. The BMPs will include an erosion control plan and other measures that will be implemented in accordance with the State General NPDES permit. Runoff from oil and chemical containment areas will be collected and routed through an oil/water separator and an effluent collection system to the ZLDF for recovery and reuse. Conformance with the State General NPDES permit will assure that storm water runoff during operations does not substantially alter erosion or siltation or violate water quality standards. Therefore, Project operations impacts related to storm water quality will be less than significant.

Storm water controls for the Site will be designed to minimize changes to existing drainage patterns and to avoid flooding and minimize erosion and siltation. Figure 2.3-9 shows the conceptual drainage plan for Site operations. Comparison of the conceptual drainage plans to existing conditions in Figure 6.5-2 shows that, on the infrequent occasions that runoff does occur, the change in runoff patterns will be minimal. Due to the minimal magnitude of change in surface drainage through and around the Site, the impact of Site operations to storm water runoff patterns will be less than significant.

The Project linear facilities will be designed so they do not interrupt storm water drainage patterns. The gas pipeline interconnection will be underground along Avenal Cutoff Road and Plymouth Avenue. The electrical line interconnection will result primarily in line tower footing disturbances and will not disrupt surface drainage. The water pipelines will be belowground, so drainage will not be affected. Considering these measures and the minimal magnitude of change in surface drainage, the operations impact of Project linear facilities to storm water runoff patterns will be less than significant.

6.5.2.2.3 Groundwater

The Project backup water supply will utilize groundwater from nearby wells. The groundwater backup supply is necessary for continuous uninterrupted operation of the Project. The surface water supply will be delivered to the Project via the San Luis Canal. Most of the year the canal provides high quality water, but occasionally the canal water, due to flooding or other disruptions, can become unusable. During these events or in the unforeseen need to operate the Project in excess of 80 percent capacity for the entire year to support California's electric needs, the Project will be able to access groundwater. Whenever the Project uses groundwater, farm practices will be altered such that an equivalent amount of reduction in agricultural pumping will occur. Thus, the amount of groundwater pumped will not increase due to the Project.

Reductions in agricultural groundwater pumping to offset use of backup groundwater pumping for plant operations will be achieved through crop changes, increased irrigation management or other measures that will offset the Project groundwater pumping in its entirety (Kochergen, 2001). Table 6.5-5 provides examples of measures that could be used to offset the Project backup groundwater pumping. Kochergen Farms comprises over 2,000 acres of active row crop and orchards surrounding the Project. Reports of backup groundwater use and offsetting water conservation measures will be provided to the Commission in the Project's Annual Report. Because there will be no increase in groundwater pumping, the Project impact on groundwater will be less than significant. With no increase in groundwater pumping, the Project will have no land subsidence impact.

6.5.2.3 Cumulative Impacts

6.5.2.3.1 Surface Water Supply

The Project will have no impact on local water supply or on other users of the San Luis Canal. Consequently, there will be no cumulative impacts.

TABLE 6.5-5

EXAMPLE WATER USE OFFSET MEASURES

CROP TYPE	TYPICAL WATER APPLICATION RATE (AF/A)	CONSERVATION MEASURE	CONSERVATION WATER USE (AF/A)	CONSERVATION WATER SAVINGS (AF/A)
Row Crop	3.0	Shift to Wheat or Barley	1.0	2.0
Almonds	3.25	Drip or Fan Jet Irrigation	2.75	0.5
Row Crop	3.0	Subirrigation	2.0	1.0

AF/A = Acre feet per year per acre of land.

6.5.2.3.2 Runoff and Drainage Water

The City's planned water turnout relocation is the only project that is close enough to have surface water impacts that could potentially be cumulative to the Project. Other projects identified in Section 6.1.4 are too far away to have cumulative surface water impacts. The Project plot plan has been designed in consultation with the City to assure that it is compatible with City plans for the relocated water turnout. No conflicts between these projects are anticipated. The City water turnout relocation will include engineering controls to prevent flooding and control run-on and runoff. There will be no disruption of surface drainage for construction and operation of the turnout because surface drainage is terminated by the canal dike, and the infrequent runoff that does occur infiltrates or evaporates where it ponds in shallow depressions that are adjacent to the canal. Because of the minor nature of impacts for both projects, the cumulative impact to surface water will be less than significant.

6.5.2.3.3 Groundwater

Groundwater used by the Project will be entirely offset, so the Project will not increase groundwater pumping in the basin. Because the Project will have no adverse impact on groundwater compared to existing conditions, there will be no cumulative impact when considered with other projects.

The availability of a surface water supply has reduced groundwater pumping since groundwater levels in the southwestern portion of the valley reached historic lows in the late 1960s and early 1970s, and water levels have recovered considerably. This has stabilized the primary mechanism responsible for subsidence that was prevalent in the San Joaquin Valley in the decades prior to the 1970s. Because the Project will have no impact on groundwater pumping in the basin, there will be no cumulative impact related to subsidence.

6.5.2.4 Design Features to Avoid Impacts

The following design and operational features of the Project avoid potentially significant environmental impacts:

- Use of the KCWA local water will not alter diversions from the Delta to the California Aqueduct and will not affect local water supplies.
- Groundwater will be used under limited conditions as a backup supply. Groundwater use will be entirely offset, so the Project will not increase groundwater pumping in the basin. Achievements of groundwater conservation to stay within historical pumping levels will be accomplished by crop rotation and irrigation conservation measures. Reports of backup

groundwater use and offsetting water conservation measures will be provided to the Commission in the Project's Annual Report.

- The Project is designed with a ZLDF that purifies and recycles process blowdown. With the ZLDF, there is no wastewater discharge from the generating process. Recycling the water purified from blowdown using the ZLDF will reduce water consumption by about 10 percent.
- The Project will occur entirely within areas that have been intensively disturbed, so there will be no impact to natural surface drainages or natural watershed areas.
- The Project linear facilities will not alter existing surface drainage. The gas pipeline interconnection will be underground. The water pipelines to the existing wells will be underground. The electrical interconnection line towers will not affect surface drainage.

6.5.3 MITIGATION MEASURES

Based on the above analysis of impacts and the design and operational features that have been incorporated into the Project, no mitigation measures are required.

6.5.4 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

There are no significant unavoidable adverse impacts to water resources from construction or operation of the Project.

6.5.5 LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

LORS related to water resources that are relevant to the Project are listed in Table 6.5-6, along with the names of the administering agencies and the Project approach to compliance. The Project will comply with applicable LORS during construction and operation. The Project will require storm water General NPDES permits for construction and for operation of an industrial facility. The NOIs to comply with these General Permits are included in Appendix 6.5-1. These NOIs will be submitted to the SWRCB prior to the onset of construction and operations, respectively, and the Project will be in conformance with these permits upon submittal of the NOIs and groundbreaking. Delivery of KCWA water to Kings County requires DWR approval. Permitting for the sanitary septic tank and leach field system is addressed in Section 2.5. No other water resource-related permits or approvals are required for the Project. Agency contacts related to water resource permits and approvals are provided in Table 6.5-7.

TABLE 6.5-6

SUMMARY OF WATER RESOURCES LORS AND COMPLIANCE

JURISDICTION	LORS/AUTHORITY	ADMINISTERING AGENCY(1)	REQUIREMENTS/ COMPLIANCE	APPROACH TO COMPLIANCE	AFC SECTION
Federal	Clean Water Act §402, 33 USC §1342; 40 CFR Parts 122-136.	Central Valley RWQCB, with oversight by State Water Resources Control Board (SWRCB) and EPA Region IX.	NPDES permit for construction activities and industrial activities, and preparation of SWPPP and Monitoring Program.	The Project will file NOIs to comply with the State General NPDES permits for both construction and industrial operations. An SWPPP and Monitoring Program will be implemented in accordance with the State General NPDES Permits.	6.5, 6.5.2.1.2, 6.5.2.2.2 Pages 6.5-2, 6.5-22, 6.5-26
	Clean Water Act § 311; 33 USC §1321; 40 CFR Parts 110, 112, 116, 117.	Central Valley RWQCB, with EPA Region IX oversight.	SPCC Plan for mitigation and reporting of any prohibited discharge of oil or hazardous substance.	Project operations will be conducted in conformance with an SPCC plan developed pursuant to federal regulations. The Project is designed to have no discharge of oil or hazardous substances. In the event of an accidental release, reporting will occur in accordance with applicable federal and state requirements and corrective measures will be implemented, as appropriate.	2.3.11.4, 6.15 Pages 2-50, 6.15-1
State	California Porter-Cologne Water Quality Control Act of 1972; California Water Code, §13000-14957, 23 CCR.	Central Valley RWQCB.	Authorizes the State to develop and implement a statewide program for water quality control.	The zero-liquid-discharge design will protect water quality. The Project will be designed and operated in conformance with the Act and implementing regulations.	2.3.7.10, 2.3.7.11, 2.3.8, 2.3.17.2, 2.3.17.3, 6.5, 6.5.1.4.1, 6.5.1.4.2, 6.5.2.1.2, 6.5.2.2.2 Pages 2-45, 2-46, 2-71, 2-72, 6.5-1, 6.5-2, 6.5-18, 6.5-20, 6.5-21, 6.5-22, 6.5-26
	California Water Code §13269; 23 CCR Chapter 9.	Central Valley RWQCB.	Waste discharge requirements for waste that can affect the quality of waters of the state.	With the zero-liquid-discharge design, there will no discharge that would require Waste Discharge Requirements other than the State General NPDES permits for stormwater.	2.3.7.10, 2.3.7.11, 2.3.8, 2.3.17.2, 2.3.17.3, 6.5, 6.5.1.4.1, 6.5.1.4.2, 6.5.2.1.2, 6.5.2.2.2 Pages 2-45, 2-46, 2-71, 2-72, 6.5-1, 6.5-2, 6.5-18, 6.5-20, 6.5-21, 6.5-22, 6.5-26
	California Constitution, Article 10 §2.	SWRCB.	Avoid wasting or unreasonable uses of water. Regulates methods of water diversion and use.	The Project has been designed to minimize water use to the extent practical, including use of a ZLDF to recycle blowdown.	2.2.2, 2.3.7.1, 2.3.7.2, 2.3.7.11, 2.3.15.8, 6.5, 6.5.1.4.2, 6.5.2.4 Pages 2-18, 2-40, 2-41, 2-45, 2-69, 6.5-1, 6.5-20, 6.5-21, 6.5-28
	California PRC §25523(a); 20 CCR §1752, 1752.5, 2300-2309, Chapter 2, Subchapter 5, Article 1, Appendix B, Part (1).	California Energy Commission.	Requires information concerning proposed water resources and water quality protection.	Required information is included in this AFC.	Section 6.5, Pages 6.5-1 through 6.5-31
Local	None applicable.	None applicable.	None applicable.	None applicable.	None applicable.
Industry	None applicable.	None applicable.	None applicable.	None applicable.	None applicable.

31161/AFC/Tbls&Figs (10/5/01/mc)

(1) Pursuant to CCR Title 20, Appendix B(h)(1)(B): Each agency with jurisdiction to issue applicable permits and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state, and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the Commission to certify sites and related facilities.

TABLE 6.5-7

ADMINISTRATIVE AGENCY CONTACTS AND PERMITTING APPROVAL AUTHORITY

LOCAL AUTHORITY OVERSIGHT/ENFORCEMENT AND AGENCY CONTACTS	PERMITTING/APPROVAL AUTHORITY[1]
California Regional Water Quality Control Board - Central Valley Region 3614 East Ashlan Avenue Fresno, California 93726 (559) 445-5156 Doug Patteson	RWQCB - National Pollution Discharge Elimination System Permit - Stormwater • Construction • Operation
California Department of Water Resources 1416 9th Street, Room 1115-2 Sacramento, California 94236-0001 Peggy Bernardy (916) 653-7084 Dan Flory (916) 653-4313	Participation and Comment
Kern County Water Agency 3200 Rio Mirada Drive Post Office Box 58 Bakersfield, California 93302-0058 John F. Stovall Gary Bucher (661) 634-1400	Participation and Comment

(1) The schedule for obtaining the NDPES Storm Water Permits for the Project is shown in Figure 2.5-1.

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